Development of SuperHERO readout electronics

Completed Technology Project (2014 - 2015)

Project Introduction

Next-generation solar hard X-ray (HXR) imagers will make high-sensitivity, high-dynamic-range observations of the signatures of accelerated electrons in solar eruptive events. Accordingly, their detectors, with associated readout electronics, must meet the requirements of spatial resolution, spectral resolution, and count rates for observing high-energy X-ray emission emitted from accelerated electrons. We will build off of ongoing development efforts to design readout electronics that can be used in flight.

The SuperHERO balloon mission concept is the next step in solar hard X-ray (~20–80 keV) instrumentation following the successful HEROES balloon mission, which launched in September 2013. As with HEROES, SuperHERO is a collaboration between GSFC and MSFC, and uses grazing-incidence hard X-ray optics to focus X-rays onto position-sensitive detectors. HEROES used gas proportional scintillation counters, but the improved angular resolution of the optics on SuperHERO and the scientific benefits of increased effective area and throughput motivates a switch to state-of-the-art pixelated solid-state detectors.

The High Energy X-ray Imaging Technology (HEXITEC) pixelated CdTe detectors developed by the Detector Development Group at the Rutherford Appleton Laboratory (RAL) are uniquely capable of satisfying all the requirements for solar X-ray imaging. They provide pixel sizes 2x smaller than any other comparable energy-sensitive detectors (250x250 um pixel pitch), have large numbers of pixels per detector (80x80, can be tiled to 160x160), and can handle 10,000 counts per second per pixel while maintaining an energy resolution of ~0.5 keV down to soft X-ray energies of 3 keV.

We are building off of ongoing development efforts to design readout electronics that can be used in flight, such as for SuperHERO. This effort is the next stage in an ongoing effort to build a hard X-ray detector system that can be used on future sub-orbital or spacecraft missions. The ongoing development efforts have been funded by the IRAD program in collaboration with MSFC and RAL. The developed and tested design for the readout electronics design can then be used on the next funded mission (e.g., balloon or sounding rocket instrument).

Anticipated Benefits

This technology can be used on any future mission (sub-orbital or spacecraft) to observe hard X-rays from astrophysical sources and/or the Sun. The pixel pitch of the detectors enables high-quality hard X-ray imaging, and the high-count-rate capability of the electronics enables good measurements of even very bright sources.

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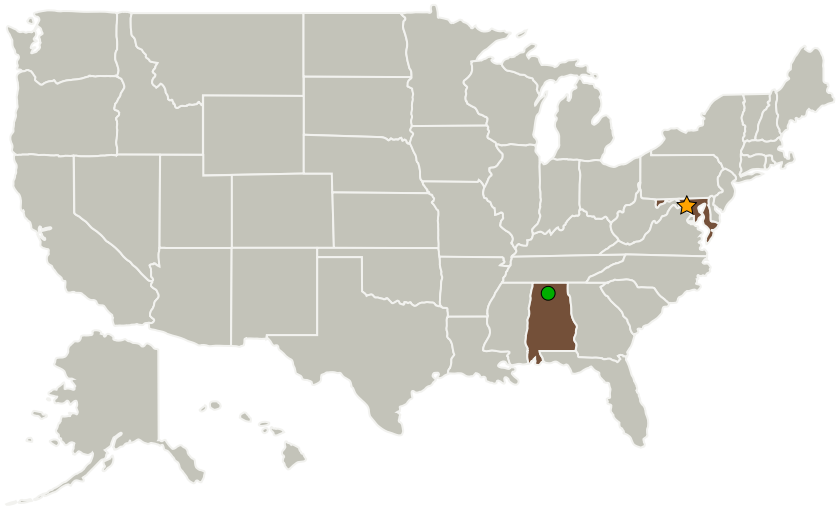
Table of Contents

Development of SuperHERO readout electronics

Completed Technology Project (2014 - 2015)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
●Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Co-Funding Partners	Type	Location
Rutherford Appleton Laboratory(RAL)	Academia	Oxfordshire, Outside the United States, United Kingdom

Primary U.S. Work Locations	
Alabama	Maryland

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

Nikolaos Paschalidis

Principal Investigator:

Albert Y Shih

Co-Investigator:

Steven D Christe

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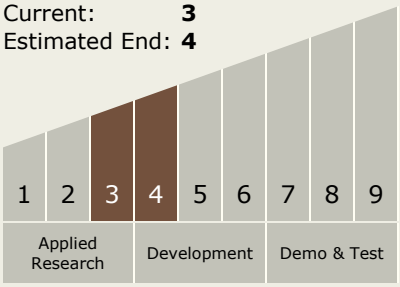
Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes